Section 5.2

Check Your Understanding, page 309:

1. A person cannot have a cholesterol level of both 240 or above and between 200 and 239 at the same time.
2. A person has either a cholesterol level of 240 or above or they have a cholesterol level between 200 and 239. $P(A \text{ or } B) = P(A) + P(B) = 0.16 + 0.29 = 0.45$.
3. $P(C) = 1 - P(A \text{ or } B) = 1 - 0.45 = 0.55$.

Check Your Understanding, page 311:

1.

	Face Card	**Non-face Card**	**Total**
Heart	3	10	**13**
Non-heart	9	30	**39**
Total	**12**	**40**	**52**

2. The probability of the event "*F* and *H*" means the probability of selecting a card that is both a face card and a heart. This probability is $P(F \text{ and } H) = 3/52 = 0.058$.
3. The probability of the event "*F* or *H*" means the probability of selecting a card that is either a heart, a face card, or both. If we add their probabilities, the face cards that are hearts will be double counted because *F* and *H* are not mutually exclusive. $P(F \text{ or } H) = P(F) + P(H) - P(F \text{ and } H) = \frac{12}{52} + \frac{13}{52} - \frac{3}{52} = \frac{22}{52} = 0.423$.

Exercises, page 314:

5.39 (a) The table below shows the possible outcomes in the sample space. (b) Each of the 16 outcomes has probability $\frac{1}{16}$.

		First Roll			
		1	2	3	4
Second Roll	1	(1,1)	(2,1)	(3,1)	(4,1)
	2	(1,2)	(2,2)	(3,2)	(4,2)
	3	(1,3)	(2,3)	(3,3)	(4,3)
	4	(1,4)	(2,4)	(3,4)	(4,4)

5.40 (a) The sample space is {HHH, HHT, HTH, THH, HTT, THT, TTH, TTT}
(b) Each of the 8 outcomes has probability $\frac{1}{8}$.

5.41 There are four ways to get a sum of 5 from these two dice: (1,4), (2,3), (3,2), (4,1). Each of these outcomes has probability $\frac{1}{16}$ so $P(A) = \frac{1}{16} + \frac{1}{16} + \frac{1}{16} + \frac{1}{16} = \frac{4}{16} = 0.25$. The probability of getting a sum of 5 is 0.25.

5.42 There are 4 ways to get more heads that tails: HHH, HHT, HTH, THH. Each of these has probability $\frac{1}{8}$ so $P(B) = \frac{1}{8}+\frac{1}{8}+\frac{1}{8}+\frac{1}{8}=\frac{4}{8}=0.50$. The probability of getting more heads than tails is 0.25.

5.43 (a) Legitimate.
(b) Not legitimate: the total is more than 1.
(c) Legitimate (even if the deck of cards is not!).

5.44 Model 1 is not legitimate because the probabilities have sum $\frac{6}{7}\neq 1$. Model 2 is legitimate. Model 3 is not legitimate because the probabilities have sum $\frac{7}{6}\neq 1$. Model 4 is not legitimate because probabilities cannot be greater than 1 and the sum of the probabilities is more than 1.

5.45 (a) The given probabilities have a sum of 0.96 and the sum of all probabilities should be 1. Thus, $P(\text{type AB}) = 1 - 0.96 = 0.04$. There is a 0.04 probability of randomly selecting a black American with type AB blood.
(b) $P(\text{not type AB}) = 1 - P(\text{type AB}) = 1 - 0.04 = 0.96$. There is a 0.96 probability of randomly selecting a black American that does not have type AB blood.
(c) $P(\text{type O or B}) = 0.49 + 0.20 = 0.69$. There is a 0.69 probability of randomly selecting a black American with type O or type B blood.

5.46 (a) The given probabilities have a sum of 0.91 and the sum of all probabilities should be 1. Thus, $P(\text{other}) = 1 - 0.91 = 0.09.$ There is a 0.09 probability that a Canadian would answer "Other."
(b) $P(\text{not English}) = 1 - 0.63 = 0.37$. There is a 0.37 probability that a Canadian's mother tongue is not English.
(c) $P(\text{neither English nor French}) = 1 - 0.63 - 0.22 = 0.15$. There is a 0.15 probability that a Canadian's mother tongue is a language other than English or French.

5.47 (a) The given probabilities have a sum of 0.72 and the sum of all probabilities should be 1. Thus, the probability must be 1 – 0.72 = 0.28. There is a 0.28 probability that a young adult has some education beyond high school but does not have a bachelor's degree.
(b) Using the complement rule, P(at least a high school education) = 1 – P(has not finished high school) = 1 – 0.13 = 0.87. There is a 0.87 probability that a young adult has at least a high school education.

5.48 (a) Using the addition rule for mutually exclusive events, P(undergraduate) = P(undergraduate students in business) + P(undergraduate students in other fields) = 0.20 + 0.15 = 0.35. There is a 0.35 probability that the customer is currently an undergraduate.
(b) Using the complement rule, P(not an undergraduate business student) = 1 – P(undergraduate business student) = 1 – 0.20 = 0.80. There is a 0.80 probability that the customer is not an undergraduate business student.

5.49 (a) $P(\text{Female}) = \frac{275}{595} = 0.462$.

(b) $P(\text{Eats breakfast regularly}) = \frac{300}{595} = 0.504$.

(c) $P(\text{Female and eats breakfast regularly}) = \frac{110}{595} = 0.185$.

(d) $P(\text{Female or eats breakfast regularly}) = \frac{275}{595} + \frac{300}{595} - \frac{110}{595} = \frac{465}{595} = 0.782$.

5.50 (a) $P(\text{Democrat}) = \frac{(47+13)}{100} = \frac{60}{100} = 0.6$.

(b) $P(\text{Female}) = \frac{(13+4)}{100} = \frac{17}{100} = 0.17$.

(c) $P(\text{Female and Democrat}) = \frac{13}{100} = 0.13$.

(d) $P(\text{Female or Democrat}) = \frac{60}{100} + \frac{17}{100} - \frac{13}{100} = \frac{64}{100} = 0.64$.

5.51 (a)

	Black	Not Black	Total
Even	10	10	**20**
Not Even	8	10	**18**
Total	**18**	**20**	**38**

(b) $P(B) = \frac{18}{38} = 0.474$; $P(E) = \frac{20}{38} = 0.526$.

(c) The event "*B* and *E*" would be that the ball lands in a spot that is black and even.

$P(B \text{ and } E) = \frac{10}{38} = 0.263$.

(d) The probability of the event "*B* or *E*" means the probability of landing in a spot that is either black, even, or both. If we add the probabilities of landing in a black spot and landing in an even spot, the spots that are black and even will be double counted because events *B* and *E* are not mutually exclusive. $P(B \text{ or } E) = \frac{18}{38} + \frac{20}{38} - \frac{10}{38} = \frac{28}{38} = 0.737$.

5.52 (a)

	Jack	Not a Jack	Total
Red Card	2	24	**26**
Black Card	2	24	**26**
Total	**4**	**48**	**52**

(b) $P(J) = \frac{4}{52} = 0.077$; $P(R) = \frac{26}{52} = 0.50$.

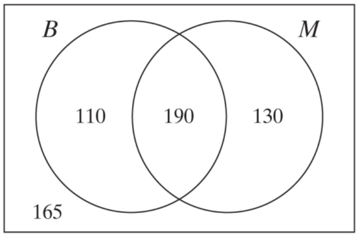
(c) The event "*J* and *R*" would be that we deal a card that is red and a jack.

$P(J \text{ and } R) = \frac{2}{52} = 0.038$.

(d) The probability of the event "*J* or *R*" means the probability of selecting a card that is a jack, red, or both. If we add the probabilities of selecting a jack and selecting a red card, the cards that are jacks and red will be double counted because events *J* and *R* are not mutually exclusive.

$P(J \text{ or } R) = \frac{4}{52} + \frac{26}{52} - \frac{2}{52} = \frac{28}{52} = 0.538$.

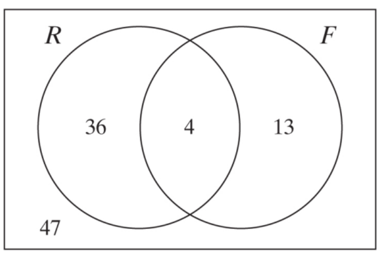
5.53 (a)



(b) $P(B \cup M) = \dfrac{110 + 190 + 130}{595} = \dfrac{430}{595} = 0.723$. There is a 0.723 probability that we select person that is a breakfast eater, a male, or both.

(c) $P(B^C \cap M^C) = \dfrac{165}{595} = 0.277$. There is a 0.277 probability that we select a female who is not a breakfast eater.

5.54 (a)



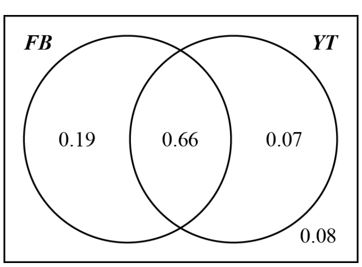
(b) $P(R \cup F) = \dfrac{36 + 4 + 13}{100} = \dfrac{53}{100} = 0.53$. There is a 0.53 probability that we select a Senator who is a Republican, a female, or both.

(c) $P(R^C \cap F^C) = \dfrac{47}{100} = 0.47$. There is a 0.47 probability that we select a Senator who is a male Democrat.

5.55 (a)

	Facebook	**Not Facebook**	**Total**
YouTube	0.66	0.07	**0.73**
Not YouTube	0.19	0.08	**0.27**
Total	**0.85**	**0.15**	**1**

(b)

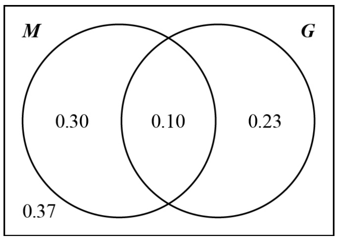


(c) $\text{FB} \cup \text{YT}$
(d) $P(\text{FB} \cup \text{YT}) = 0.85 + 0.73 - 0.66 = 0.92$. I used the general addition rule.

5.56 (a)

	Mac	**PC**	**Total**
Undergraduate	0.30	0.37	**0.67**
Graduate	0.10	0.23	**0.33**
Total	**0.40**	**0.60**	**1**

(b)



(c) $\text{M} \cap \text{G}$
(d) $P(\text{M} \cap \text{G}) = 0.10$. I looked for the intersection of the two events in the Venn diagram.

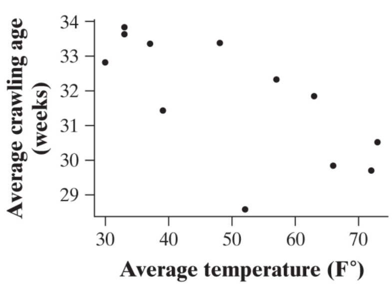
5.57 c

5.58 b

5.59 (was 5.60) c

5.60 (new/revised) c

5.61 The scatterplot for the average crawling age and average temperature is given below.



In this scatterplot, there appears to be a moderately strong, negative linear relationship between average temperature and average crawling age. In fact, the correlation is $r = -0.70$. The equation for the least-squares regression line is $\widehat{\text{age}} = 35.7 - 0.077\text{temp}$. We predict that babies will walk 0.077 weeks earlier for every degree warmer it gets.

5.62 We should use a randomized block design because using patients from different countries might increase the variation in the response variables. Use the 10 medical centers as blocks and randomly assign half of the women in each center to receive ranelate and the other half to receive the placebo. At each center, write each woman's name on a slip of paper, mix the papers in a hat, and choose half to get the ranelate. The remaining women at each center get the placebo. At the end of the study, measure the bone density and counts of new fractures.